



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

MEMORANDUM

February 18, 2000

SUBJECT: Response to Public Comments on the Preliminary Risk Assessments for the Organophosphate Disulfoton

FROM: Christina Scheltema, Chemical Review Manager
Special Review and Reregistration Division
Office of Pesticide Programs (7508W)

TO: OPP Public Docket for Disulfoton
Docket # 34165B

Introduction

This document addresses public comments that were received in response to EPA's Notice of Availability (64 FR 1199, January 8, 1999) of preliminary risk assessments for the following organophosphate chemicals: acephate, disulfoton, methamidophos, oxydemeton-methyl, and pirimiphos-methyl. This document addresses comments specific to disulfoton.

Five commentors responded to the Federal Register Notice. Comments were received from the technical registrant (Bayer Corporation), from grower groups, and from the North Carolina Cooperative Extension Service. Bayer's comments focused on proposed label changes and possible refinements to the risk assessment. The National Potato Council submitted five comments regarding risks, benefits, and pending worker risk mitigation for disulfoton use on potatoes. The California Asparagus Commission commented on the assumptions used in the dietary and worker risk assessments, the need to retain disulfoton to control certain pests, the value of the California asparagus crop, and alternatives for disulfoton. The Washington State Asparagus Commission commented on the benefits of disulfoton to asparagus growers, on the importance of disulfoton to growers competing in an international market, and on asparagus field trial data which was not used in the preliminary risk assessment. The Watauga County Nurserymen's Association submitted three, and the North Carolina Cooperative Extension Service submitted two, comments regarding the use of disulfoton on Christmas Tree farms.

Note: Since the close of the public docket in March, 1999, significant refinements have been made to both the human health and ecological risk assessments for disulfoton. Through the public comment process, the Agency received proposed label changes (potential risk mitigation) and an acute probabilistic (Monte Carlo) dietary risk assessment from the registrant. The revised human health and ecological risk assessments that are now available in the Public Docket and on the Agency's website: www.epa.gov/pesticides.

A. Response to Comments on the Preliminary Human Health Risk Assessment

Bayer Corporation

Comment: Bayer proposed a number of changes to the disulfoton labels. These changes included reducing the number of applications per season, reducing application rates, limiting the total amount of disulfoton that can be applied to tobacco in a single year, eliminating foliar application on cotton, voluntarily canceling four major uses (tomatoes, oats, corn, and pecans), and voluntarily canceling Di-Syston Systemic Insecticide for Vegetables (EPA Reg. No. 3125-126).

EPA Response: The Agency considered both the current and proposed labels in the revised risk assessments for disulfoton. The Agency will not make the label changes final until the public has had a chance to comment on the proposed changes. Details of the proposed label changes will be placed in the OPP public docket and on the Internet, and the public will have 60 days to comment on the feasibility of the label changes. If no adverse comments are received, the Agency will process these label changes as an interim, incremental risk reduction measure. To process the proposed use deletions and the voluntary cancellation of the registration for Di-Syston Systemic Insecticide for Vegetables, EPA would follow the standard Agency procedure of issuing a Federal Register Notice announcing the deletions and cancellation under section 6(f) of FIFRA, which allows for public comments.

Comment: Bayer will submit a Tier III analysis (Monte Carlo) at the end of May 1999. Information will be provided on methods used in the analyses. The preliminary results of this analysis show no dietary risk concern for disulfoton. The Bayer Tier III Analysis included field trial data, updated estimates of market share and percent crop treated, and processing factors. [The Acute Dietary Monte Carlo analysis was submitted on May 5, 1999.]

EPA Response: The Agency has considered the Tier III dietary exposure analysis submitted by the registrant in the revised risk assessment. The Agency has also conducted its own acute probabilistic dietary risk assessment, which included the refinements mentioned by Bayer, as well as additional refinements. The revised acute dietary risk assessment shows exposures at the 99.9th percentile comprise less than 10% of the acute population adjusted dose. Dietary exposures less than 100% of the acute population adjusted dose are not of concern to the Agency.

Comment: Bayer believes that data support the use of an Uncertainty Factor (UF) which is less than 100-fold for risk assessment purposes and that the weight-of-evidence indicates that humans are not more sensitive than animals to organophosphate-induced cholinesterase inhibition.

EPA Response: The uncertainty factors for disulfoton exposure were recommended by the Hazard Identification Assessment Review Committee (HIARC) based on responses from the FIFRA Science Advisory Panel of June, 1997 on organophosphates and on information available at the time of the HIARC meeting. A 100-fold uncertainty factor was applied to risk assessment to account for intra (10) and interspecies (10) variation. The FQPA Safety Factor for disulfoton was removed (i.e., a 1X FQPA Safety Factor was used). The Agency does not agree that the weight of evidence offered by Bayer provides an adequate basis for reducing uncertainty factors.

Comment: Bayer comments that MOEs will improve once the proposed label amendments are adopted and options such as closed systems are used.

EPA Response: The Agency agrees that the proposed label amendments and options such as closed systems will reduce exposure and concomitant occupational risks from disulfoton. The Agency has quantified MOEs based on the changes to the terms and conditions of registration proposed by Bayer. Although the proposed label amendments are a step in the right direction, they are not sufficient in and of themselves to address the Agency's risk concerns.

Comment: Bayer commented that a study (MRID No. 446880-01) was not used in the evaluation of post-application exposure.

EPA Response: This study was received by the Agency on November 5, 1998. Because the preliminary occupational and residential exposure assessment for disulfoton was completed on May 21, 1998, this study was not included in the preliminary risk assessment. Since then, the study has undergone preliminary review, which shows that this study did not meet all guideline criteria. Most importantly, the study did not use a sampling interval sufficient to establish a residue dissipation curve. However, the Agency agrees with the registrant that the data indicate disulfoton dissipates relatively rapidly. Therefore, the information on the rapid dissipation of disulfoton was considered in the revised risk assessment even though the study did not satisfy all guideline criteria.

Comment: Bayer believes the residential risk evaluation is a very preliminary, extremely conservative assessment based on default assumptions that do not reflect actual data on the use and the exposures from uses.

EPA Response: The Agency acknowledges that the residential risk assessment for disulfoton published in January 1999 was preliminary. However, this residential risk assessment (and the current risk assessment), using the best data available to the Agency, indicates that the risks to residential handlers are substantially above the Agency's level of concern. Additional information about the use of disulfoton in residential settings could refine these estimates.

Comment: Bayer believes it is inappropriate to include a Tier II exposure analysis for water in the FQPA assessment.

EPA Response: Tier II estimated drinking water exposure is derived from PRZM/EXAMS and SCI-GROW models for ground water estimated levels. The Agency uses Tier II models to estimate potential pesticide exposure from water. Although the Agency does not include Tier II models in quantitative risk assessment, these estimates are used to compare potential exposure with a Drinking Water Level of Comparison, or DWLOC. The DWLOC is the calculated acceptable concentration of a pesticide in water when food, water, and residential exposure are all considered.

Washington Asparagus Commission

Comment: The commentor noted no residues of disulfoton or its three metabolites were detected in field trials for asparagus conducted in New Jersey, Washington, Michigan, Arizona, and California using three applications at the shortest possible pre-harvest intervals. Asparagus typically receives one or two applications of disulfoton. FDA survey data found that 100% of domestic asparagus contained no detectable residues of any pesticide, including disulfoton.

EPA Response: The Agency agrees that there were no detectable residues of disulfoton on asparagus in either field trial or FDA monitoring data. The revised dietary risk assessment uses FDA monitoring data. Consistent with its policy, EPA used a value of one-half the level of detection, adjusted for the percent of crop treated, as the anticipated residue for asparagus in the revised dietary risk assessment for disulfoton.

California Asparagus Commission

Comment: EPA's preliminary dietary risk assessment used conservative assumptions: 100% crop treated and tolerance level residues. These assumptions result in an overestimate of dietary risk.

EPA Response: EPA agrees that conservative assumptions regarding percent crop treated were used in the preliminary dietary risk assessment. EPA agrees that use of 100% crop treated and tolerance level residues results in an overestimate of risk. These conservative assumptions were used for screening purposes. EPA has subsequently incorporated more realistic percent crop treated values into the revised risk assessment. The revised disulfoton risk assessment also incorporates anticipated residue values based on field trial data and/or FDA monitoring. These anticipated residue values replace the tolerance level residue values used in the preliminary risk assessment.

Comment: Some of EPA's assumptions regarding worker exposure do not apply to asparagus or any other crop. There is no direct contact with asparagus ferns after disulfoton

application. The only activities that occur after disulfoton application are mowing, chopping, incorporating, or removing asparagus ferns in November or December.

Response: The Agency did not conduct a worker risk assessment specific to asparagus. EPA's worker exposure assessment is based on formulation, application method, and amount applied, rather than on crop-specific parameters. The worker exposure assessment focuses on pesticide exposure during mixing, loading, and application of disulfoton. Therefore, agricultural practices specific to asparagus were not considered. The Agency sometimes utilizes information about agricultural practices for re-entry assessments. However, for disulfoton, the re-entry interval for asparagus is 48 hours in accordance with the Worker Protection Standard, based on the classification of disulfoton as Toxicity Category I. The limited re-entry data for disulfoton show that it dissipates within 48 hours at applicator rates < 4lbs ai/A, so the re-entry interval for crops with low rates is based on the acute toxicity category.

The National Potato Council

Comment: Disulfoton is not a carcinogen.

EPA Response: The Agency agrees with this comment. No evidence of carcinogenicity was seen in two adequately conducted carcinogenicity tests of disulfoton in the mouse and rat. Potential carcinogenicity is not considered a factor in the hazards associated with disulfoton. Therefore, a risk assessment based on carcinogenicity was not conducted for disulfoton.

Comment: Disulfoton rarely appears as a residue on food crops. According to the USDA Pesticide Data Program, 694 and 707 samples of potatoes were screened for residues of disulfoton in 1994 and 1995, respectively. Of the combined 1,401 samples, disulfoton was detected in only 1 sample, at about 1% of the tolerance. Based on the low level and number of detections, it is unlikely that use of the product on potatoes will pose an unreasonable dietary risk.

EPA Response: The Agency agrees that there are few detections of disulfoton *per se* on food crops. However, the Agency is also concerned about detections of the degradates disulfoton sulfone and sulfoxide. Although PDP data were considered in the dietary risk assessment, FDA monitoring data were used to derive anticipated residues because they monitored for both parent and degradates. The Agency believes that the FDA data comprise the most complete set of residue monitoring data for disulfoton. PDP data did not monitor for the degradates.

Comment: Disulfoton will be available in closed loading systems starting next growing season. The closed loading systems will reduce worker exposure to disulfoton.

EPA Response: The Agency agrees that closed loading systems will likely reduce worker exposure to disulfoton. Closed loading systems, which are a type of engineering control, have been considered in the revised disulfoton risk assessment. However, use of engineering controls

does not sufficiently mitigate worker risk for most occupational scenarios. Even with engineering controls, short-term MOEs range from 1.6 to 1000 and intermediate-term MOEs range from < 1 to 440.

B. Response to Comments on the Preliminary Ecological Effects Risk Assessment

Bayer Corporation

General Comments

Comment: EPA's use of application rates and numbers in the preliminary risk assessment was incorrect because Bayer is proposing to change application rates, numbers, and amounts.

EPA Response: The Agency has factored Bayer's proposed rate changes into the revised risk assessment to determine their impact as potential risk mitigation. As stated earlier, EPA cannot finalize any label changes until the Agency has received public comment on the proposed changes.

Comment: Bayer requests that the Agency refine its ecological risk assessment for disulfoton by incorporating more realistic estimates of chemical use rates, application scenarios, and wildlife feeding parameters, and by using field-measured residue levels and dissipation rates in place of conservative default values for these parameters. The refined assessment should be based on the recently revised labels to more accurately reflect the growers needs and resolve any ambiguity with respect to the permissible use patterns.

EPA response: The application rates for disulfoton used in the preliminary risk assessment were obtained from information submitted by the registrant (July 10, 1997) and from current labels (EPA Reg. Nos. 3125-172 and 3125-307). The Agency's revised ecological risk assessment was based on current label rates. However, EPA has also considered the new rates proposed by Bayer in the revised risk assessment. These rates were examined as a means of possible risk reduction.

Comment: Bayer submitted a refined terrestrial risk assessment for disulfoton to the Agency in 1989 (MRID No. 41359101) and refined aquatic exposure and risk assessments for disulfoton to the Agency in 1997 (MRIDs 44373101 and 44373102). These and other documents Bayer has previously submitted contain information that has apparently not yet been used by the Agency in a refined ecological risk assessment for disulfoton. Bayer also criticized EPA for not utilizing EPA guidance for estimating an aquatic decay rate.

EPA response: The Agency has reviewed these documents and has included much of the previously provided information in the revised risk assessment. The Bayer aquatic exposure and risk assessment report presents EECs for disulfoton and disulfoton degradates sulfoxide and sulfone using PRZM/EXAMS models. Some of the input values used by the registrant in their

modeling (such as half-life values for disulfoton in soil and aquatic environment) followed Agency guidance for input parameter estimation and selection, while some did not (such as half-life estimates for sulfoxide and sulfone in soil and aquatic environment). Although Bayer criticized EPA for not utilizing Agency guidance for estimating an aquatic decay rate, Bayer did not follow all aspects of the guidance.

A number of required input values were not available and therefore had to be derived using best professional judgment. Among the missing data were mobility estimates (K_d s) of the degradates, and aerobic and anaerobic aquatic (formation and) degradation rates for disulfoton, sulfoxide, and sulfone. Thus, there is considerable uncertainty in the estimates of disulfoton (parent and degradates) loading to the standard pond and its dissipation in the aquatic system (degradation and binding). EXAMS was also not parameterized to consider degradation products (i.e., the EXAMS input parameters TPROD and YIELD, defined in the EXAMS manual on pages 100 and 103, respectively).

Some of these data limitations might be addressed with additional fate studies, including an anaerobic soil metabolism study and an aerobic aquatic metabolism study on disulfoton and degradates, and fate studies on the sulfoxide and sulfone degradates. Bayer mentioned these studies in their December 8, 1998 "Error Correction" letter, but none of these data have been submitted to date.

Water Resources Assessment

Comment: The water resources assessment must be performed using sound science and best professional judgement. In a previous public comment [Error Correction], Bayer identified clear errors in the assessment which EPA has not acknowledged to date.

EPA response: The Agency agrees that the water resource assessment should be conducted using sound science and best professional judgement. However, EPA notes several factors of uncertainty and variability regarding the fate of disulfoton. The disulfoton data on which modeling inputs are based show a wide variability in (bi-phasic) metabolism rates. There is also substantial variability and uncertainty in the monitoring data. Finally, there is wide variability in the environment into which disulfoton is released which will result in a wide range of exposures. All of these factors contribute to uncertainty in whether modeled estimates and interpretations of monitoring data account for what could happen in the environment. EPA's selection of input parameters and analysis of monitoring data allow for these uncertainties and account for variability in environmental conditions. This results in choosing appropriately conservative but reasonable inputs and monitoring results which produce exposure estimates that accommodate the range of environmental exposures. While these choices are intended to bracket the upper end of disulfoton exposure expected in the environment, they are never made with the intention of exaggerating or maximizing exposure. In both surface and ground water monitoring data, parent disulfoton was detected at similar levels or in some instances higher levels than predicted by modeling. Therefore, the Agency does not believe that the water resources

assessment is overly conservative for high exposure conditions. Monitoring studies for other pesticide have also shown water concentrations that are comparable to or greater than those estimated by modeling.

Comment: EPA's Tier II surface water modeling assessment includes application rates that are no longer current. The scenario yielding the highest exposure involved two non-incorporated granular applications to potatoes at a rate of 9.39 lbs ai/A with 14-day intervals. Bayer is proposing to remove this use from the labels.

EPA Response: The Agency has updated the surface water modeling to include lower rates, where these lower rates are on EPA-approved labels. Bayer has also proposed some rate changes which have not yet been approved by the Agency because the changes were submitted during the public participation process for disulfoton. The Agency has factored Bayer's proposed rate changes into the revised risk assessment to determine their impact as potential risk mitigation. As mentioned earlier, the Agency cannot finalize any label changes until the public has had an opportunity to comment on the proposed changes.

Comment: Bayer submitted a Water Resources Assessment (MRID 44373101) in September 1997 which utilized Tier II methodology consistent with OPP's policy. This important report was neither acknowledged nor considered in EPA's summary of the data available [in the preliminary water resources assessment]. Bayer also met with EPA scientists to discuss this report.

Response: The Agency has reviewed Bayer's 1997 Water Resources Assessment. However, Bayer used different assumptions and methodologies than those supported by the Agency. Some of these differences are enumerated below.

Bayer was actually inconsistent when using OPP's Tier II methodology, primarily using it only when estimates of degradation would be enhanced and avoiding the guidance when degradation would not be enhanced. For example, there are differences in the calculation of an aerobic aquatic dissipation rate when no data are available. The aerobic aquatic dissipation rate is an input parameter for the Agency's Tier II water model, PRZM-EXAMS.

Comment: EPA's water resources assessment uses methodology which is inconsistent with Agency policy for Tier II modeling. Bayer believes that the Agency made an error in the water resources assessment by not utilizing an aerobic aquatic dissipation rate equal to twice the aerobic soil metabolism dissipation rate when aquatic data are not available, as per OPP's established policy. Using OPP's current dissipation rate for aquatic soil metabolism, an estimated aerobic aquatic half-life of ~40 days should have been used in the water resources assessment. Instead, EPA assumed no microbial degradation occurs in water, which results in an overestimate of the amount of disulfoton residues available in the water column.

EPA Response: Aerobic aquatic degradation was not considered in modeling of the

EECs in the preliminary water resources assessment due to lack of data and a literature source that raised a question about aquatic degradation. In a review article on environmental fate, Howard (1991) indicated that it was unclear whether disulfoton is susceptible to biodegradation in natural waters. This was based upon the biodegradation of disulfoton in some soil studies, where sterilized and non-sterilized soil lead to conflicting conclusions regarding the differentiation of chemical and biological degradation of disulfoton in soil. Although EPA did not include aerobic aquatic degradation in the water modeling, aerobic aquatic degradation was considered qualitatively. The preliminary risk assessment stated that the fate of disulfoton could not be modeled with a high degree of certainty because there were no data on aerobic and anaerobic aquatic degradation rates. However, because of the rapid microbial degradation in soil (aerobic soil metabolism half-life <20 days) and direct aquatic photolysis, EPA assumed that the disulfoton parent would degrade fairly rapidly in water. The Agency also noted that the monitoring data tended to confirm the rapid decline of disulfoton. Monitoring data were too limited or not available to evaluate the degradates, sulfoxide and sulfone.

Bayer is not entirely correct in stating that current EPA guidance suggests using a value set to twice the aerobic soil metabolism half-life when an acceptable study does not exist and hydrolysis is presumed stable. EPA's guidance states that the PRZM aerobic soil metabolism rate can be multiplied by 0.5 (or half-life times 2). When only one aerobic soil metabolism half-life value is available, the PRZM aerobic soil metabolism rate is determined by multiplying this single value by 3 for uncertainty. When more than one aerobic soil metabolism half-life value is available, the PRZM aerobic soil metabolism rate is determined by taking the 90th percentile upper bound of the mean aerobic soil metabolism half life. This value is then multiplied by an uncertainty factor of 2 for extrapolation across media (water versus soil). These methods are used as a way to try to incorporate uncertainty and yet provide a conservative assessment. However, these methods do not substitute for an adequate database.

The aquatic exposure assessment submitted by Bayer (MRID 44373101) used single values for the aerobic soil metabolism degradation rates for disulfoton, sulfoxide, and sulfone in water, at 5.5, 17, and 150 days, respectively. These single values were not multiplied by 3 or used to estimate an upper bound for the soil metabolism rate, and were also not multiplied by 2 to account for uncertainty due to extrapolation from one media to another, as recommended in Agency guidance.

The Bayer exposure assessment report (MRID 44373101) used hydrolytic degradation rates (half-lives) in aqueous solutions at 30 °C (pH4 - 39 to 42 days, pH7 - 23 to 25 days, pH9 - 2.2 to 2.5 days) and 40 °C (pH4 - 18 to 21 days, pH7 - 11 to 12 days, pH9 1.1 to 1.3 days). The degradation rates (half-lives) at 20 °C (which better reflects environmental temperatures and the temperatures in the standard pond) were 1174, 323, and 232 days for pH4, 7, and 9, respectively. Thus, the Bayer exposure assessments appear to significantly overestimate the contribution of hydrolysis at environmental temperatures to the degradation of disulfoton.

EPA has also run the modeling using an estimated aquatic half-life value for parent

disulfoton and the total disulfoton residues. Because aquatic degradation rates are not available, the assumption of no aquatic degradation is also discussed. Using an aerobic aquatic half-life for disulfoton estimated from the aerobic soil metabolism half-life will lower the estimated concentrations (more rapidly decline over time), thus, decreasing the conservativeness of the estimate without reducing the uncertainty. The decline curve of total disulfoton residues followed a first-order degradation pattern (i.e., straight line of the natural logarithm). The half-life for the total disulfoton residues ranges from 119 to 217 days. The 90 percent upper bound on the mean of the half-lives is 259 days.

Comment: Data exist which relates chemical use to areas sampled in NAWQA. Bayer states that five NAWQA study units with full data reported are in high-disulfoton use areas (NAWQA study units twenty two, twenty three, forty eight, fifty, and fifty six). The maximum value observed in agricultural streams (0.041 ug/L) may be indicative of disulfoton residues in water bodies that might be used to supply small community water systems. This value is much lower than EPA's modeled surface water concentrations for disulfoton.

EPA response: The Agency recognizes that the NAWQA data suggest that disulfoton was used in a number of study areas. However, the NAWQA data do not report the spatial and temporal relationship of the disulfoton usage to the monitoring sites. NAWQA data also do not report how the runoff events correspond to the monitoring data. EPA considered the information from the NAWQA study in its qualitative water assessment for disulfoton parent, when stating that disulfoton parent would degrade fairly rapidly in water. The NAWQA monitoring data does not provide any information about the disulfoton degradates which may be a greater concern, due to their longer persistence. The NAWQA data will also not help in determining a peak concentration.

The percent of crop area treated must be considered in evaluating the monitoring data. On July 10, 1997, Bayer submitted information stating that percent of crop treated (sprayed) ranged from 0.02% (soybeans) to 4.74% (lettuce). For cotton, 4.7% of the total acres grown were treated. Therefore, it is not possible to use the monitoring data to substantiate the claim made by Bayer that the maximum disulfoton value of 0.04 ppb observed in agricultural streams represents an upper bound concentration of disulfoton in small streams located in agricultural areas. More recent NAWQA data reports a maximum disulfoton concentration of 0.060 µg/L.

Bayer presented an incident report (Incident Report No. I001167-001) where water samples collected after a fish kill incident in Colorado contained 29.5-48.7 µg/L of the sulfoxide degradate and 0.0199-0.214 µg/L of the sulfone degradate. The source of the disulfoton was Di-Syston 8 EC applied to wheat before a heavy rainfall. These degradate concentrations would suggest the potential for parent disulfoton concentrations in water to be much greater than the 0.04 ppb suggested by the Bayer.

Comment: Bayer does not agree with EPA's use of aerobic soil metabolism half-life data in developing the modeling input parameter for the aerobic soil metabolism rate.

EPA Response: The available aerobic soil metabolism data used to derive the aerobic soil input parameter data indicated a two-step or bi-phasic degradation pattern that made deriving a single dissipation rate uncertain. In two-step dissipation patterns, the metabolism rate in the first step is often much more rapid than in the second step. In such cases, EPA must ultimately decide what dissipation rate to use. If the dissipation rate from the first step is used, it does not account for the persistence in the second step. If the dissipation rate from the second step is used, it does not account for the rapid metabolism in the first step. The Agency ultimately selected an aerobic soil metabolism rate of 6.12 days as a basis for deriving the aerobic soil metabolism rate for modeling. This is the upper 90% confidence bound on the mean of "half-lives" for the two aerobic soils tested in the laboratory (MRIDs 40042201, 41585101, 43800101). Bayer used essentially the same process as the Agency, using, with few exceptions, the same data in a similar way to derive modeling inputs for the Bayer aquatic exposure and risk assessment.

Comment: Several issues are identified by Bayer concerning the aerobic metabolism half-life, or rate of decline. The major concern is whether the decline of disulfoton in soil follows first-order kinetics.

EPA Response: The information reported in MRID 43800101 suggests non-first order kinetics and a half-life less than the "calculated" 15.6 days as indicated. The 15.6 day half-life was apparently calculated by the registrant and only represents a portion of the data (days 0 through 90; days 122, 241, and 367 were not included). The slope of the transformed (natural log) data was significant with $p=0.0001$ and a r^2 of 0.888. From a statistical standpoint, a first-order model using transformed data provides a reasonable estimate of the decline rate. However, the time in which the initial pesticide concentration reaches half the initial concentration (i.e., half-life) is less than the 15.6 days suggested by the analysis of the transformed data. Approximately 10 percent of applied radio-labeled disulfoton was reported to be in the sulfoxide state at time zero (day 0 < 6 hours) which suggests rapid oxidation to the corresponding sulfoxide and sulfone degradates. A second study reports a half-life of 1.9 days (MRID 41585101). This estimate only used the natural logarithm transformed disulfoton percentages from the first three days (0, 0.25, 1, and 3 days) of the experiment. The remaining days 7, 14, 30, 90, 189, 270 were not considered. The decline of parent disulfoton (in this study) also appears not to follow first-order kinetics.

Comment: Bayer states that 5.5 and 4.1 days (MRID 43800101 and 41585101, respectively) would be better estimates of half-lives, determined by a series of partial differential equations to derive reaction rate constants using non-linear methods.

EPA Response: In the revised water resources assessment, EPA used the 5.5 and 4.1 day half-lives proposed by Bayer because they are longer than the half-lives of 2.8 and 1.6 days estimated by EPA. The Agency's estimates of 2.8 and 1.6 days were derived with nonlinear regression. The 90th percentile upper bound on the mean aerobic soil metabolism half-life of disulfoton parent is 6.1 days. This would result in an estimated aerobic aquatic half-life of 12.2 days (2×6.1 days, according to OPP guidance).

EPA is concerned about the "half-lives" or rates of formation and decline of the degradates. Literature suggests that disulfoton is transformed via microbial metabolism and chemical oxidation (Howard et al., 1991). Primary transformation products in soil are disulfoton sulfoxide and sulfone. Five oxidative metabolites, which persisted for more than 12 weeks (84 days), were identified in a paddy soil (Howard et al., 1991). Data generally suggests that in soil disulfoton will rapidly oxidize. Reported half-lives tend to be less than 5 days. However, metabolites (sulfoxide and sulfone) tend to be more persistent. The registrant estimated DT₅₀s of 5.5, 17, and 150 days, respectively, for disulfoton, the sulfoxide, and the sulfone (MRIDs 4437391 and MRID 44373101). However, the algorithms used to estimate these values were not specified and therefore could not be confirmed.

Comment: Bayer suggests that results from modeling efforts be compared against monitoring data as a reality check to provide some indication of the conservatism built into EPA's Tier II water resources assessment.

Response: The Agency has compared results from monitoring with the Tier II modeling for disulfoton. This comparison shows that the modeling is not overly conservative. EPA has also compared results from modeling with monitoring data for a number of pesticides where there are more monitoring data than there are for disulfoton. In EPA's comparison, water monitoring data for some pesticides showed levels of either a similar or greater concentrations than those predicted by EPA's modeling. For some chemicals, monitoring data have been greater than the modeled EECs. Further, most monitoring data for pesticides, including disulfoton, do not include degradates, which are of concern for disulfoton and other organophosphate insecticides.

EPA's surface water modeling accounts for slope and soil properties assumed for vulnerable areas. The scenarios used in modeling are not a biased collection of high-end conservative combinations of site-related input parameter values. Instead, the model inputs are based on real world (actual site) interdependent combinations of slope, soil properties, crop, and application methods and scenarios. In addition, when Tier II modeling is triggered, variation in meteorological conditions is accounted for by use of time series of actual meteorological measurements. The meteorological data are used probabilistically in that the concentrations used in risk assessment are values exceeded with an estimated frequency of once every 10 years.

Comment: Bayer indicates that a number of steps have already been initiated to address some of the outstanding issues. These include an anaerobic aquatic or anaerobic soil metabolism study and an aerobic aquatic metabolism study on disulfoton. Bayer also indicates that studies are being considered to characterize the fate of the sulfoxide and sulfone degradates in soil and water.

EPA Response: The Agency has not received data from any of these proposed studies to date. EPA believes that this information is necessary to better understand the fate of disulfoton and disulfoton degradates in the environment. EPA hopes that this information will allow for a clear understanding of the decline and formation of disulfoton and its degradates, their persistence

in soil and water, and their mobility and binding affinities.

Aquatic Risk Assessment

Comment: The EECs for estuarine and marine organisms are based on a freshwater pond scenario that has no inflow or outflow.

EPA Response: The Agency acknowledges that the results of freshwater models used to screen for potential risk to estuarine organisms are highly uncertain. In many cases, the exposure will be lower, because of dilution as the tide moves water back and forth. Certainly long-term exposure in estuaries is less likely to mimic ponds. However, peak concentrations in slow-moving backwater estuaries, with input only from treated areas, may contain concentrations similar to those in a pond. This would represent an upper bound exposure.

Comment: Bayer believes that the use of more accurate use rates in the aquatic risk assessment would result in different conclusions. In 1997, Bayer submitted an aquatic exposure and risk assessment (MRIDs 44373 101 and 44373 102, respectively) to EPA. Bayer believes that their assessment is based on more accurate use rates. Bayer's aquatic risk assessment concludes that the acute risk to fish should be classified as restricted use and that the high risk LOC is not exceeded for any use pattern. Bayer also concludes that acute risk to freshwater invertebrates should be classified as either restricted use or high risk, depending on the use pattern. There is approximately a 15-fold difference between the acute risk quotients calculated by EPA and those calculated by Bayer. Overall, Bayer believes the acute and chronic risks to fish is minimal from the use of disulfoton. Bayer believes that disulfoton poses a greater risk to aquatic invertebrates. However, invertebrate risks are reduced to an acceptable level based on the restricted use classification of disulfoton.

EPA Response: The Agency has considered the proposed label changes in the revised risk assessment. The Agency has refined the aquatic risk assessment by modifying the chemistry input parameters, which resulted in reduced peak and chronic exposure values. The risk concern for acute and chronic effects, especially to aquatic invertebrates, remains. However, a microcosm study for disulfoton shows that the invertebrate community may have the potential for recovery when disulfoton concentrations are between 10 and 30 ppb. However, the microcosm study also demonstrated that there would be some mortality to bluegill sunfish at levels as low as 3 ppb. More details are provided in the revised aquatic risk assessment.

Comment: Results of life-cycle toxicity tests with *Daphnia magna* for the degradates disulfoton sulfoxide and sulfone were not included in the preliminary risk assessment (MRIDs 437380002 and 43738001, respectively).

EPA Response: These studies were not included in the preliminary risk assessment for disulfoton. However, these studies have been evaluated and are included in the revised aquatic hazard assessment/toxicity tables. Although both degradates are one to two orders of magnitude

less chronically toxic than parent disulfoton to *Daphnia magna*, it is likely that residues of the degradates will be present in some aquatic systems. Therefore, invertebrates would be at chronic risk even after concentrations of disulfoton have declined below levels of concern.

Terrestrial Risk Assessment

Comment: Bayer claims that it is a misuse of the Fletcher nomogram to calculate EECs for soil application. Bayer also cites EPA's review of a Disulfoton residue study (no MRID cited), which concluded that disulfoton residues were not expected to cause adverse effects to wildlife.

EPA Response: The Agency's exposure assessment of a liquid formulation even to bare soil assumes direct contamination of invertebrates and seeds. Although soil incorporation may reduce the quantity of food items on the soil surface, those items remaining above ground are readily available to be consumed. Similarly, depending upon the efficiency of removing vegetation by the cultural practice used to prepare the field and the degree of subsequent weed control, vegetation may be present at the time of application. The risk quotient (RQ) tables reflect EPA's screen of a use pattern and assume direct exposure to food items, but do not address the magnitude, i.e., the amount of substrate available. The risk characterization section of the revised risk assessment was modified to clarify the situation, especially for the in-furrow use of liquid Di-Syston 8 EC.

As demonstrated by two field residue monitoring studies in potatoes (MRIDs 41116901 and 41201801), systemic insecticides such as disulfoton do appear in various media, including invertebrates and plants, even when a product is soil incorporated. The former study reflected incorporated liquid Di-Syston 8 EC and the latter study examined aerial application to foliage. According to an agreement between Bayer and EPA, the study did not include carcass searching. EPA acknowledged in the preliminary risk assessment that those residues were not expected to cause adverse effects to wildlife. Nevertheless, there is some uncertainty as to the "safety" of all soil applications due to several factors. First, non-target organisms are exposed to residues not only through the diet, but also via dermal and inhalation routes. Second, these residues reflect only a limited data set. Third, some species such as Swainson hawks appear to be much more sensitive than laboratory test birds, such as bobwhite quail and mallard duck. The revised terrestrial risk assessment has been modified to reflect the results of these studies.

Comment: Use of Fletcher's upper limit for three consecutive applications reaching EPA's maximum EEC has a probability of only 0.00012. Therefore Bayer believes this estimate is overly conservative.

EPA Response: The residue data from Bayer's field monitoring studies for azinphos methyl in Washington (Johnson et al. 1989; MRID 41139701) and Michigan (Sheeley et al. 1989; MRID 41195901) apple orchards show that maximum Fletcher values can indeed be equaled or exceeded in the field. Those data show that mean measured residues on Michigan apple tree

foliage actually exceed maximum Fletcher values; some samples exceeded maximum Fletcher values three- to four-fold. Maximum Fletcher values were a good estimate of mean measured residues in Washington orchards, although some samples were considerably higher than estimated EECs. In adjacent habitat subject to drift (assumed to be 5% for airblast application), measured residues on vegetation exceeded predicted maximum Fletcher EECs by three- to four-fold and predicted mean Fletcher EECs by nine- to ten-fold. Therefore, use of maximum Fletcher EECs seemed warranted for azinphos-methyl and may be appropriate for disulfoton when applied with airblast equipment. The Agency based its RQs solely on dietary exposure via contaminated food sources. Other routes of exposure, including dermal, inhalation, and drinking from contaminated puddles might also be important (Driver et al. 1991) and further increase acute risks if included in the risk assessment.

Comment: Bayer states that Fletcher's data base did not contain an individual value for residues resulting from a 1.0 lb ai/ acre to short grass any greater than 194; therefore, EPA should not use 240 ppm. Furthermore, Bayer believes that the Agency should not use the reported maximum value, but instead use a 5% exceedance value (which for 240 ppm is 198).

EPA Response: The Agency used the results of both Fletcher et al. (1994) and Hoerger and Kenaga (1972) to support the conclusion that 240 ppm represents a reasonable upper bound for 1 lb applied to short grass. This has not changed in the revised risk assessment.

Comment: Bayer reports that field residue data on insects indicates a seven-fold lower value than those used by the Agency. EPA has adopted Kenaga's suggestion of assuming residues on large and small insects equate to fruits and forage, respectively.

EPA Response: The Agency has only a limited data base for actual residue data on insects/invertebrates and therefore has followed Kenaga in assuming levels on insects may be comparable to those on forage and seed pods based on similar surface-to-volume ratios. EPA agrees that there is much uncertainty in this presumption. EPA will examine the Fisher data if Bayer submits it for review. EPA acknowledges that the two previously discussed residue monitoring studies on potatoes showed residues on insects and invertebrates to be much lower than on the potato foliage. There is some uncertainty associated with these results because the collected organisms may not have received direct exposure. Although the revised risk assessment did not include RQs for insect and invertebrate exposure, EPA will continue to allow for the potential equivalency of residues on insects and forage until a more dependable model becomes available.

Comment: Bayer requests that EPA refine its ecological risk assessment by using field measured residue levels and dissipation rates. The Agency used a half-life of 15.6 days (from a soil metabolism study) to model the dissipation of disulfoton in calculating terrestrial EECs. This value is inconsistent with a wealth of data that indicates that the foliar half-life of disulfoton is significantly less than 15.6 days. The three extensive field studies generated average foliar half-lives ranging from 1.5 to 3.3 days depending on the matrix and the study for the Total Toxic Residues (TTR) of disulfoton. The TTR include all metabolites that are suspected to be of

toxicological concern. These values are also consistent with the two other soil metabolism studies that EPA classified as supplemental, the soil dissipation study, and the photodegradation study where half-lives were all < 4 days. Clearly, disulfoton does not persist very long in the environment and the use of 15.6 days as a foliar half-life is unjustified. A value of 3.3 days can be used as a accurate and reliable estimate for the foliar half-life of disulfoton.

EPA Response: Foliar dissipation was considered in the revised risk assessment. EPA used the information presented by Bayer when appropriate. The terrestrial EECs were redetermined for disulfoton residues using the 3.3 day half-life value based upon Bayer's comments and EPA's reassessment of the data and disulfoton application information.

Comment: Bayer states that due to disulfoton's rapid metabolism in rats (MRID 0071877 and 40471101), dietary risk for small mammals should not be based on the potential number of LD50s per day that may be consumed.

EPA Response: The Agency agrees that estimating dietary LC50's from LD50 data has a high degree of uncertainty. If mammal dietary LC50 values were available, these would be used. Bayer had suggested that based on the similarity in the toxicity between demeton and disulfoton, demeton's rat dietary LC50 of 320 ppm may be appropriate for disulfoton. However, the 95% confidence interval for the study was zero to infinity. Therefore, the assumption as to whether 320 ppm is a credible value even for demeton has some uncertainty. Furthermore, although there was limited or no mortality at the lowest test concentration in the two avian dietary LC50 tests, any mortality negates the idea that disulfoton will not cause some mortality when organisms are exposed to their LD50 in the course of feeding. In fact there is a greater likelihood for mortality if the organism is gorging rather than feeding continuously under the relatively stress free conditions of the laboratory. In conclusion, the acute oral LD50 study results suggest that disulfoton is highly toxic to mammals, and residues in the field seem to be high enough to represent an acute risk.

Comment: Small mammals as seen in the work by [Bennett et al. \(1994\)](#) and [Wang et al. \(1999\)](#) do not access foliage with high residues.

EPA Response: The Agency notes that Bennett and Wang measured residues on alfalfa, which is a very dense crop with a closed canopy. Their findings cannot be widely extrapolated to all vegetation, especially short grass. Moreover, not all small mammals feed only on vegetation within a few inches of the ground. Rats, for example, can easily feed on ripening rice panicles situated at the top of standing rice plants. On other vegetation, such as short turf-like grass, the canopy may be easily accessible to even the smallest mammals.

Comment: Bayer contends that wildlife, especially birds, will obtain much of their food away from treated fields and thus, EPA's assessment overestimates exposure. They believe a refined assessment, like that done for chlorfenapyr, should be done for disulfoton.

EPA Response: The assessment for chlorfenapyr was based on field data collected at the

proposed use site (cotton). Bird use of cotton fields in southern states cannot be used to refine risk assessments for other birds exposed to other chemicals in other regions. Many small mammals may obtain most if not all of their food within a treated field. Birds are generally more mobile than mammals, but it is possible that a bird nesting in a the hedgerow might obtain most food for itself and its young within a nearby treated field. The Agency can refine the risk assessment only if data are provided for the specific situations under which disulfoton is used.

Comment: EPA's original review of the granular disulfoton study (MRID 410560-01) and the draft ecological risk assessment stated that this study documented wildlife mortality from the use of the 15G formulation on potatoes. In 1989, Bayer submitted a detailed rebuttal to the original EPA review of this study; key points of this rebuttal were repeated in their 60-day comments. Remains of 29 birds and mammals were found during the course of carcass searches. Two-thirds of these were clearly unrelated to disulfoton treatment based on timing and circumstances and not a single animal was found for which the most probable cause of death was pesticide exposure. All carcasses that could be analyzed lacked detectable residues of disulfoton or metabolites. An additional 31 small mammals were found dead in traps during the study. None of these contained detectable residues of disulfoton or metabolites. The number of carcasses found per unit of search effort was greater prior to disulfoton applications than it was after applications.

EPA Response: One carcass (a pipit) was considered highly likely to have been poisoned by disulfoton. Only 2 of the 32 casualties were analyzed for disulfoton residues. Based on the Agency's guidance for terrestrial field studies (EPA 1986), EPA concluded that the amount of area searched (5.5 acres) was not sufficient and that transects were too far apart for locating carcasses. However, EPA believes that this study provides useful information, despite the study deficiency, because it demonstrated mortality to wildlife inhabiting treated potato fields.

Comment: The preliminary ecological risk assessment listed three incident reports in which birds have allegedly been killed by disulfoton use. As is the case for many wildlife incident reports, information is incomplete and it is not always apparent how exposure occurred or if the incident resulted from a legal use of the compound. Two of the incidents apparently involved non-agricultural applications: one at a tree nursery in Delaware and one at a private residence in Puerto Rico. The lone incident involving an agricultural application involved a seed-treatment application. These incidents are largely irrelevant to EPA's assessment. They should not and can not be used as evidence that EPA's predictions of high risk have been confirmed.

EPA Response: The lack of reported incidents is not an indication that there are no adverse effects occurring from the use of a pesticide. Such factors as the proximity of mortality to where people will see the incident; finding the carcass prior to it being scavenged; except for a large animal, the difficulty in seeing a carcass; and the uncertainty that an observed incident will be reported are just a few reasons why EPA is not confident that all negative impacts will be reported. Whenever the residues of a particular pesticide are detected and others are not, the weight of evidence will be seen in support of the chemical as the causative agent. Although the details of how exposure to a chemical occurs are frequently limited, the Agency believes it would

be irresponsible to overlook such reports, other than those attributed to a misuse or intentional poisoning.

North Carolina Cooperative Extension Service

Comment: The commentor submitted a study evaluating the effects of Christmas tree production on aquatic macro invertebrates in adjacent streams. The study was entitled: “Evaluation of Christmas Tree Farming and Cattle Grazing on Water Quality in the New River Basin, Ashe and Alleghany Counties.”

EPA Response: The Agency has reviewed this study. The study was a descriptive observational study, rather than a controlled field experiment. As the former, it discusses summary “results” and conclusions drawn from these observations and measurements, and the authors provide interpretations based on their field experience and a good knowledge of local conditions and practices. However, the study does not employ a properly controlled and replicated design that would allow for conclusions of “association” among factors, nor can one draw definitive conclusions about the basic question of significant differences among sites. As a result, there are confounding factors throughout, such as sites that are mixed cattle grazing and tree farming, or mixed land use in other crops, or the employment of an IPM program at one of the tree farming sites. The authors are aware of the existence of these, and tend to explain the mixed results in terms of their influence, which is probably accurate.

The study objective, to “compare areas with few Christmas trees to areas having moderate to heavy concentrations of Christmas trees...[to]...show if Christmas tree farming was having any impact on the stream fauna...” is somewhat limited in scope, but also ambitious to achieve without larger numbers of “replicate” fields and the measurement of many intermediate and possibly “intervening” variables. For example, the authors indicate that temperature, specific conductivity, substrate percent, and canopy scores probably have a large effect on the richness and abundance of the stream life. With so few example sites studied, however, they are unable to examine the possible effects of tree farming itself because these variables were not constant across the sites. Rather, the elevation (and temperature) at one or two sites, the confounding presence of cattle grazing (and erosion) at one or two of the tree farming sites, and the pH and dissolved oxygen at certain sites were seen as factors affecting the outcome variables. As such, they obscure any possible effects of the tree farming itself. In addition, the objective of the study does not appear to include examining the effect of disulfoton (tree) use on stream fauna, since no measurements of this chemical or its degradates appear to have been taken, even in the season of use. In fact, in one of the two sites selected for high tree use, it was acknowledged that because of the small size of the many trees, little disulfoton was thought to have been used around the time of the sampling. Thus, if disulfoton exposure is one mechanism of the influence of Christmas tree farming on the aquatic biota, its effects were also obscured.

California Asparagus Commission

Comment: The Agency should use more refined models for the environmental risk

assessment.

EPA Response: The Agency has incorporated more of the information submitted by Bayer.

National Potato Council

Comment: Disulfoton has not been detected in ground water.

EPA Response: Disulfoton has been detected in ground water in studies conducted by Virginia Polytechnic Institute and State University in Virginia where disulfoton concentrations ranged from 0.04 to 2.87 µg/L and in a Wisconsin Department of Natural Resources (WDNR) study in Wisconsin where concentrations ranged from 4.00 to 100.00 µg/L. The concentrations of parent disulfoton reported in these studies (VA and WI) significantly exceeded the estimate of 0.05 µg/L obtained from the Agency's SCI-GROW (ground-water screening model) model. The SCI-GROW estimated concentration of total disulfoton was 3.19 µg/L, although no monitoring data are available for comparison. The SCI-GROW model represents a vulnerable site, but not necessarily the most vulnerable site treated, with the maximum rate and number of disulfoton applications, while assuming conservative environmental properties. The degradates were assumed to have the same mobility as parent disulfoton and the 90 percent upper bound on the mean half-life of the total residues was used for the total disulfoton residues.

Several issues, including the lack of QA/QC in the monitoring data collected by the Wisconsin Department of Natural Resources and the lack of follow-up sampling to detect disulfoton residues in ground water as suggested by Holden, have been considered by OPP in the ground-water quality assessment.

EPA considered several points when making these recommendations. First, the Virginia and Wisconsin monitoring studies were probably conducted in areas vulnerable to ground-water contamination. The level of certainty with respect to vulnerability is probably greater for Wisconsin (relatively less uncertainty) than for Virginia (relatively more uncertainty). The occurrence of preferential flow and transport processes has been noted in Wisconsin (and is also possible in Virginia) and may have contributed to the high concentrations (especially in Wisconsin) when the initial sampling occurred, but not necessarily in the follow-up sampling. The knowledge concerning the disulfoton use in areas in association with the wells is not well known (high uncertainty).

The monitoring sites and detections in these data bases, especially NAWQA study areas do not necessarily target highly vulnerable areas such as the Central Sand Plains in Wisconsin. Disulfoton parent is not very persistent in aerobic soil conditions which may explain the lack of detections in follow-up monitoring in Wisconsin. The authors of the Virginia study did not present any information that would suggest that EPA should not consider the disulfoton detections reported in that study.

The Central Sands of Wisconsin are known to be highly vulnerable to ground-water contamination. There are regions within the United States that have conditions that are highly vulnerable to ground-water contamination and regularly have pesticides detected in ground water which far exceeds values seen elsewhere. Several of these areas are well documented, e.g., Long Island, Suffolk County, New York and Central Sand Plains in Wisconsin. The Agency does not believe it is appropriate to base national regulations on these highly vulnerable sites. These sites should be protected through other means.

Watauga County Nurserymen's Association

Comment: Disulfoton has never been detected in the surface or ground water in several studies conducted in the Christmas tree growing region of North Carolina.

EPA Response: The Agency neither agrees or disagrees with this comment. EPA has not seen any of the monitoring studies mentioned by the Watauga County Nurserymen's Association (WCNA). A report by the Division of Water Quality Biological Assessment Unit dated December 8, 1998, was submitted with the WCNA comment, but this study appears not to have measured pesticide concentrations. Also, the Ashe/Alleghany County region is not located within NAWQA study units with water monitoring data. No studies for North Carolina are reported in the Agencies Pesticides in Ground Water Data Base which included disulfoton. EPA will consider any studies which analyze water samples for disulfoton or disulfoton degradates in the water assessment.

C. Comments on Disulfoton Use and Benefits

California Asparagus Commission

Comment: About 30,000 acres of asparagus are planted in California, from which a crop worth \$90 million is harvested. Disulfoton is a critical tool in the production of asparagus in California. Asparagus growers need to retain disulfoton to control the asparagus aphid. Without the ability to control asparagus aphid, the California asparagus industry would collapse.

EPA Response: The California Asparagus Commission did not provide information on asparagus pest management that would allow the Agency to evaluate the importance of disulfoton to the California asparagus industry. Additional information on this topic would be useful. Fortunately, the Washington Asparagus Commission submitted an in-depth assessment of asparagus production, the European asparagus aphid, and the role of disulfoton in controlling this pest. EPA will consider information on the importance of disulfoton to asparagus growers when the Agency drafts a preliminary Reregistration Eligibility Decision (RED).

Comment: Pesticide use records from the California Department of Pesticide Regulation indicate that nowhere near 100% of the California vegetable acreage was treated with disulfoton in 1995. Furthermore, the nationwide use data collected by the National Center for Food and Agriculture Policy (NCFAP) indicates that disulfoton was rarely used on more than 15% of

vegetable acreage. Please review these data for estimates of percent crop treated and NCFAP's survey for rates applied to determine the probability of an individual or wildlife consuming food or coming into contact with plant that have been treated at the maximum rate for acute exposures.

EPA Response: The Agency's preliminary risk assessment used percent crop treated data from a June 1997 quantitative usage analysis (QUA), which provided estimates of percent crop treated based on all data available at the time, including California's Department of Pesticide Regulation, USDA's National Agricultural Statistics Service (NASS), NCFAP, and two proprietary data sources. The revised risk assessment uses an updated QUA, which contains revised estimates of percent crop treated based on additional pesticide use data recently procured by the Agency. For asparagus, the likely maximum percent crop treated estimate was raised from 53% to 55% based on recent data indicating high use in California and Washington. The California Department of Pesticide Regulation estimated that 56.96% of the California asparagus was treated in 1995 (27,595 lbs ai applied), and 62.97% was treated in 1996 (38,137 lbs ai). Proprietary data sources estimated similar use in California for 1996 (39,600 lbs ai), and slightly higher amounts applied in both California and Washington for 1997 (43,000 lbs ai). The average percent crop treated projection was lowered based on USDA estimates which estimated the total (US) asparagus acreage treated with disulfoton at 36% in 1992, 42% in 1994, and down to 26% in 1996. Unfortunately, NASS did not present estimates for each of these states in each year. The overall percent crop treated estimates are made for total US acreage: there are approximately 30,000 acres planted to asparagus in California, 24,000 acres planted in Washington state, and 18,000 acres planted in Michigan, with smaller acreage in various other states. According to NASS, disulfoton is used mainly in the west coast states.

Washington State Asparagus Commission

Comment: The Washington Asparagus Commission (WAC) cited the European asparagus aphid as one of the major pests facing asparagus growers in Washington and California. Damage from this pest results from a toxin that aphids inject into the plant when feeding. The toxin causes important damage to subsequent years growth. The resulting distorted growth reduces the plant's ability to nourish the plants crown and will cause dessication after 1 to 2 years feeding by this pest. In addition, the toxin may delay spring bud break producing a profusion of small spears simultaneously. The impact of this pest is even more pronounced on newly established plants, weak plants, and seedling beds.

Pesticides recommended to control European asparagus aphid include disulfoton, chlorpyrifos, pyrethrin/rotenone, and narrow range oil. However, chlorpyrifos is registered for ground application only. Neither pyrethrin/rotenone or narrow range oil provide as efficacious control of the European asparagus aphid as does disulfoton. There are not alternatives for use in California for this pest. Use of disulfoton allows Washington growers to remain competitive in the world market.

EPA Response: The Agency acknowledges the tenuous position facing asparagus growers in Western States. EPA appreciates the information on asparagus pest management and

the economic analysis provided by the Washington Asparagus Commission to support the use of disulfoton. This information will be considered when the Agency drafts an interim RED.

National Potato Council

Comment: In their comments, the National Potato Council (NPC) provided information regarding the use and importance of disulfoton on potato production. Disulfoton is used to control aphids, particularly green peach aphid, which transmits various viral diseases of potatoes. The most important use of disulfoton [by potato growers] is for the prevention of the development of resistance and the second most important use pattern is protection for pollinators. Data from the USDA NASS show that disulfoton has been applied to as many as 70,000 acres of potatoes per year.

EPA Response: The Agency appreciates these useful comments regarding the benefits of disulfoton on potatoes. EPA also notes that all available data, including NASS and proprietary data sources, were utilized in composing its pesticide use projections.

Watauga County Nurserymen's Association

Comment: The commentor stressed the importance of disulfoton and dimethoate to control Rosette bud mite in the production of Fraser fir Christmas trees in the North Carolina Mountains. The commentor provided several advantages of disulfoton, such as efficacy in controlling spider mites, cost-effectiveness, ease of application on steep mountain Christmas tree plantations. Alternatives require expensive equipment (large tractor and air blast sprayer) to apply.

The commentor also stressed that loss of dimethoate and/or disulfoton will have significant negative impacts on North Carolina Christmas tree industry. Fraser fir is the major agricultural crop in several North Carolina mountain counties, with an annual profit of approximately 100,000 million dollars.

North Carolina State University Cooperative Extension Service (Dr. Jill Sidebottom)

Comment: Jill Sidebottom, Extension Forestry Specialist, North Carolina State University, Cooperative Extension Service, commented that twig aphids and spider mites may cause significant damage to Fraser firs. Disulfoton is not only effective at controlling these pests, but it also plays a role in the Fraser fir IPM program since it does not reduce natural predatory mite activity as do other insecticides (such as Asana or lindane), and it often provides adequate season long control of spider mites, reducing the need for subsequent treatments. The NC State Cooperative Extension Service web site profiles Fraser fir Christmas tree production in North Carolina. This web site provides an in-depth overview on each of the major pests, as well as pesticides used to control each of these pests by Christmas tree producers in this area. An estimated 65% of the 23,000 acres (NC-Mountains) are treated each year with disulfoton; with application rates typically between 3 lbs ai - 4.5 lbs ai/acre (1 application per season-spring). A

total of 52,500 lbs ai are applied in North Carolina , where disulfoton is registered for use according to section 24(c) of FIFRA. In summary, there will be severe economic impacts to the North Carolina Christmas tree industry should disulfoton be canceled.

EPA Response: The Agency appreciates these comments and will consider the benefits of disulfoton in any regulatory decision. EPA finds the claims made and information provided by the WCNA and Sidebottom very credible. EPA has very little information on pesticide use on conifers in general, and in North Carolina Fraser firs in particular, and is appreciative of the time and effort the North Carolina State University researchers spent composing the crop profiles for North Carolina Christmas Trees. EPA agrees that Christmas tree producers may experience significant potential losses if disulfoton is not available considering: the importance of cosmetic appearance upon market value of Christmas trees, the risks associated with the long term investment of producing Christmas trees (6 to 12 years to maturity), the costs of controlling pests, and the observation that a significant percent of growers (65% of acreage) are shown willing to absorb the costs of applying disulfoton to treat for the balsam twig aphids and other pests.

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